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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/705,698	11/08/2003	Ji-Yen Cheng	78438-244401	5239
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Venable LLP Raymond J. Ho 575 7th Street NW Washington, DC 20004-1601			EXAMINER MILLER, MICHAEL G	
			ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/705,698	Applicant(s) CHENG ET AL.	
	Examiner MICHAEL G. MILLER	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 January 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) 8, 10 and 12 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7, 9, 11, 13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

- 1) Examiner notes the grammatical corrections to Claims 1, 7, 11.
- 2) Examiner notes the amendment to Claim 12 to depend solely from Claim 1.
- 3) Claims 8, 10 and 12 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species (8, 10) or invention (12), there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 29 JAN 2008.
- 4) Examiner acknowledges the substitute specification submitted 29 JAN 2008. No new matter is added in the specification. However, entry of the substitute specification is denied because it is improper to include the claims in the substitute specification. See 37 CFR 1.125 and 1.121 for more details.

Response to Arguments

- 5) Applicant's arguments filed 29 JAN 2008 have been fully considered but they are not persuasive.
- 6) Applicant's first argument is that Henry does not teach the use of silanes with PMMA. Examiner acknowledges this point and points out that Henry teaches the adhesion of a chemical group to the amino-functionalized surface of PMMA in Schemes 1 and 2. Fulcrand teaches the adhesion of a chemical group to the functionalized surface and teaches that the surface can be functionalized with either

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amino groups (as taught by Henry) or by hydroxyl groups formed by olefinic reaction, depending on what was desired to be attached. It would therefore still have been obvious to a person having ordinary skill in the art at the time the invention was made to combine Henry/Klank with Fulcrand, as Henry/Klank is adhering a compound to a surface via amino functionality and Fulcrand teaches that compounds can be adhered to surfaces using either amino or hydroxyl functionality depending on the desired adhesion.

- 7) Applicant's second argument is that none of Henry, Klank and Fulcrand individually teach generating hydroxyl groups on a PMMA surface. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).
- 8) Applicant's third argument is that Klank is being applied incorrectly, as Klank teaches neither modifying the surface of the trench as claimed nor producing smooth trenches as claimed. Examiner respectfully points out that neither of these above points are actually claimed. No claim mentions the surface of the trench; no claim mentions the smoothness of the trench walls.
- 9) Applicant's fourth argument is that McMurphy does not accurately teach using LAH in an environment reflecting the claimed environment. Examiner respectfully disagrees and points out that Fulcrand uses a reactive hydrophilic moiety to generate the hydroxyl groups through methods well known in the art. In this case, one end of the

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chemical in the moiety is capable of bonding to the surface of the substrate while the other end is capable of reacting with the LAH to form the hydroxyl group. McMurry was known in the art at the time Fulcrand was invented and therefore is encompassed by Fulcrand's statement that the reactive moiety can comprise olefins which can be converted to hydroxyl groups by methods known in the art.

10) Applicant's fifth argument is that Claim 13 contains patentable subject matter by virtue of defining an annealing temperature which is not taught by Klank. Examiner respectfully disagrees. As discussed in the previous office action, Klank performs two annealing steps. The first annealing step occurs during the formation of the trenches, as the laser raises the temperature of the polymer above its glass transition point in the act of melting the polymer and carving the trench; the second annealing step as cited by Applicant occurs later in the process to relieve stresses. However, there is still an annealing step which inherently takes place above the glass transition temperature of 105 degrees Celsius.

11) As all arguments are found non-persuasive, Examiner maintains all previous grounds of rejection.

12) The rejection of Claims 1-7, 9, and 11 are presented below for the Applicant's convenience with the new rejection of Claim 13.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the

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art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claim 13 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. In particular, Claim 13 claims annealing at any temperature above the glass transition temperature of 105 degrees Celsius. The specification only supports annealing at 170 degrees Celsius; it does not support the range from 105 - 169 or 171+ degrees Celsius.

Claim Rejections - 35 USC § 103

13)The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

- a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

14)The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148

USPQ 459 (1966), that are applied for establishing a background for determining

obviousness under 35 U.S.C. 103(a) are summarized as follows:

- i) Determining the scope and contents of the prior art.
- ii) Ascertaining the differences between the prior art and the claims at issue.
- iii) Resolving the level of ordinary skill in the pertinent art.
- iv) Considering objective evidence present in the application indicating obviousness or nonobviousness.

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- 15) Claims 1-5, 7, 9, 11 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Henry et al ("Surface Modification of Poly(methyl methacrylate) Used in the Fabrication of Microanalytical Devices", Analytical Chemistry, 72, 21, 5331-5337, hereinafter Henry) in view of Klank et al ("CO₂-laser micromachining and back-end processing for rapid production of PMMA-based microfluidic systems", Lab on a Chip 2, 2002, 2, 242-246, hereinafter "Klank") and Fulcrand et al (U.S. Patent 6,319,674, hereinafter '674).
- 16) With regard to Claim 1, Henry teaches a method for preparation and surface modification of a plastic microfluidic chip, comprising:
- a) Subject said substrate to physical surface modification (5332 paragraph 3, wherein the substrates are machined on edge to a given size, therefore physically modifying the surface area); and
 - b) Treat said substrate with a surface modification agent (5332 paragraph 3, exposure to N-lithioethylenediamine or N-lithiodiaminopropane).
 - c) Henry is silent as to the following limitations:
 - i) Prepare a plastic substrate is prepared;
 - ii) Form a pattern with desired trench size and aspect ratio in said plastic substrate;
 - iii) Treat surface of said substrate is treated with chemical reduction to produce hydroxyl groups (-OH).
 - d) Henry also teaches that is known to produce polymer-based MEMS by laser ablation (5331 paragraph 4).

- e) Klank teaches a method of preparing a plastic substrate (242, paragraph 4, naming PMMA) by forming trenches of a given size and aspect ratio by laser ablation (last two paragraphs of 243 – first two paragraphs of 244).
- f) Examiner takes the position that laser ablation is physical modification of the surface, both by changing its topography and by locally annealing the sidewalls of the carved trenches.
- g) Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to have modified the method of Henry with the method of Klank, as Henry is modifying a material to be used in making MEMS devices and Klank is preparing a material to be used in making MEMS devices.
- h) Henry/Klank are silent as to the following limitation:
 - i) Treat surface of said substrate is treated with chemical reduction to produce hydroxyl groups (-OH).
 - i) Henry teaches reaction of a compound with amino-functionalized surfaces to adhere the compound to a substrate (5332, Schemes 1 and 2).
 - j) '674 teaches treatment of a surface to provide hydroxyl groups (Column 14 Line 46 – Column 15 Line 35; see specifically Column 15 Lines 15-20 for a surface with -OH termination) through which a compound can adhere to the surface.
- k) Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to have modified the method of Henry/Klank with the technique of '674 because Henry/Klank want to adhere chemical

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molecules to functional groups on a surface and '674 teaches that chemical molecules can be adhered to –OH functional groups on a surface.

17)With specific regard to Claim 2, Henry/Klank/'674 teaches the method according to claim 1 wherein:

a) Said plastic substrate is a PMMA substrate (Klank 242, paragraph 4).

18)With specific regard to Claim 3, Henry/Klank/'674 teaches the method according to claim 1 wherein:

a) Said plastic substrate is carved with a laser scribe to form said pattern (Klank 242, paragraph 5).

19)With specific regard to Claim 4, Henry/Klank/'674 teaches the method according to claim 3 wherein:

a) Said plastic substrate is carved with a direct write laser scribe to form said pattern (Klank 242, paragraph 5, as the laser is directly carving the channel and not a byproduct from the laser).

20)With specific regard to Claim 5, Henry/Klank/'674 teaches the method according to claim 1 wherein:

a) Said physical surface modification comprises thermal annealing treatment (Klank 242 paragraph 6 – 243 paragraph 4, discussing the melting of the material in the trench and the heating of the trench walls, which constitutes localized thermal annealing).

21)With specific regard to Claim 7, Henry/Klank/'674 teaches the method according to claim 1 wherein:

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- a) Said surface modification agent comprises amino functional groups (Henry, 5332 paragraph 3).

22)With specific regard to Claims 9 and 11, Henry/Klank/'674 teaches the method according to claim 1 wherein:

- a) Said surface modification agent comprises aminated organosilanes (Column 14 Line 64 – Column 15 Line 35 for the modification agent, Column 9 Lines 20-40 for the mention of the polymethacrylate family, of which PMMA is a member).
- b) Claim 11 is rejected on the same basis as Claim 9 (Column 14 Lines 64-67 teach 3-(aminopropyl)triethoxysilane; Column 15 Lines 31-35 teach that the silyl functionality can be triethoxysilane or trimethoxysilane).

23)With specific regard to Claim 13, Henry/Klank/'674 teaches the method according to claim 1 wherein:

- a) Said plastic substrate is annealed with a temperature that exceeds a glass temperature of 105 degrees Celsius (Klank 242 paragraph 6 – 243 paragraph 4, discussing the melting of the material in the trench and the heating of the trench walls, which constitutes localized thermal annealing above the glass transition temperature).

24)Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over

Henry/Klank/'674 in view of McMurry ("Organic Chemistry", Brooks/Cole Publishing Company, 1984, pp 639-640, hereinafter McMurry).

25)With specific regard to Claim 6, Henry/Klank/'674 teaches the method according to claim 1 except for the following limitation:

- a) Said reduction agent comprises lithium aluminum hydride (LAH).
- b) McMurry teaches that lithium aluminum hydride is known to reduce ester compounds to primary alcohols, yielding hydroxyl functional groups (pp 639-640).
- c) Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to have modified the method of Henry/Klank/'674 to include the technique of McMurry, as Henry/Klank/'674 want to modify the PMMA surface and McMurry teaches that the ester portion of the PMMA surface can be modified to a hydroxyl group.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL G. MILLER whose telephone number is (571)270-1861. The examiner can normally be reached on M-F 7-4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on (571) 272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Michael G. Miller/
Examiner, Art Unit 1792

/Michael Cleveland/
Supervisory Patent Examiner, Art Unit 1792